The Crop Ontology development

**Trait Dictionary template**
- Developed by the Crop Ontology and the Integrated Breeding Platform to support the creation of ontologies
- Populated by breeders with their traits, observation methods and reporting scales

The Breeding Management System uses the Trait Dictionaries to:
- Create breeders’ fieldbook
- Annotate and store breeders’ data

**The Crop Ontology online tool features:**
- The publication of ontologies from the Trait Dictionary template or OBO files
- The browsing of term definitions and relations
- An Application Programming Interface to provide databases and web applications with ontologies in Excel, OBO, RDF, JSON formats

**Improvement in phenotype annotation**

To annotate phenotypes, Crop Ontology supplies breeders with:

- **Traits** i.e. the observed plant entities (e.g. leaf, grain) and attributes (e.g. color, weight)
- **Methods** i.e. the protocols to observe the trait
- **Scales** i.e. the units or categories that can express the trait observation

Thus, a plant phenotype had to be annotated with 3 identifiers for the trait, the method and the scale, respectively. Yet, breeders’ fieldbooks and phenotype databases are often designed to annotate a datapoint with only one identifier.

In May 2015, Crop Ontology has consequently been revised to integrate 3 identifiers for the trait, the method and the scale.

**Examples of variables:**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Trait</th>
<th>Method</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>PltHt_Meas_cm</td>
<td>Plant height in cm</td>
<td>Measure the height of a plant with a ruler</td>
<td>cm</td>
</tr>
<tr>
<td>PltHt_Av_cm</td>
<td>Plant height average</td>
<td>Compute the average of 5 to 10 plant height measurements</td>
<td>cm</td>
</tr>
<tr>
<td>PltHt_Meas_0to5</td>
<td>Plant height on a 0 to 5 scale</td>
<td>Visually estimate the average plant height</td>
<td>Score</td>
</tr>
<tr>
<td>GW100_Meas_kg</td>
<td>100 grain weight</td>
<td>Weigh a defined number of grains. Then, divide the weight by the number of grains and multiply by 100</td>
<td>g per 100 grains</td>
</tr>
</tbody>
</table>

**CO schema upgrade**

**Data annotation with variables**

In the Breeding Management System:

In Nextgen databases:

- CO_00000000: CGMIR cassava trait ontology
- CO_00000001: Cultivar specific trait
- CO_00000002: Arboecucurcucumulatula
- CO_00000036: Ease of Harvest

**Online visualization**

**Next Steps**

- Complete the upgrade of the Trait Dictionaries
- Start upgrading the Trait Dictionaries of banana and potato
- Upload the Trait Dictionaries in the Breeding Management System 4.0
- Release curation guidelines
- Add crops: cacao, faba bean, sunflower, forage, grape, beetroot, woody plants
- Translate the Trait Dictionaries into relevant languages